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we knew the latter numbers and their orders, we would know the orders of all the numbers, since the order of the product of two such numbers is the product of their orders. In the case when $p=3$, the operators whose orders divide $p-1$ are 1 and $p^a - 1$. Hence, in this case, the order of every number is known. In particular, the primitive roots of p^a are the products of $p^a - 1$ into the numbers of the form $1+kp$ (k being prime to p), as is well known.

Even the number 2 presents difficulties which have not been overcome. That is, we do not know the order of the operator which transforms each operator of G into its square. The well known number theory results along this line; that is, those which relate to the quadratic character of 2, may be stated in group theory language as follows: In the number group formed by the natural numbers which are prime to p and less than p^a , the order of 2 divides $\frac{p^a-1(p-1)}{2}$ only when p is of the form $8n \pm 1$. When p is not of this form the order of 2 must involve the highest power of 2 contained in $p-1$.

A SHORT PROOF FOR THE NUMBER OF TERMS IN A DETERMINANT WHICH ARE INDEPENDENT OF THE ELEMENTS OF THE PRINCIPAL DIAGONAL.

By ORLANDO S. STETSON, Syracuse University.

The problem of finding the number of terms, $\varphi(n)$, in the given determinant which are independent of the elements of the principal diagonal may be reduced to the question of finding the number of terms in the expansion of the *invertebrate* determinant Δ_n (second formula for $k=n$, MONTHLY, 1904, page 167).

Hence

$$\begin{aligned} \varphi(n) = & n! - n(n-1)! + \frac{n(n-1)}{1.2}(n-2)! - \frac{n(n-1)(n-2)}{1.2.3}(n-3)! \\ & + \dots + (-1)^{n-1} \frac{n(n-1)(n-2)\dots 3.2}{1.2.3\dots(n-1)}(1)! + (-1)^n \frac{n(n-1)(n-2)\dots 3.2.1}{1.2.3\dots n} \end{aligned}$$

Removing from each of the terms the factor $n!$ and noticing that the first two terms are equal but opposite in sign, we have

$$\varphi(n) = n! \left[\frac{1}{1.2} - \frac{1}{1.2.3} + \frac{1}{1.2.3.4} - \dots + (-1)^n \frac{1}{1.2.3\dots n} \right].$$